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"TERMINAL NETWORK" DIGITAL PLATFORM AS AN OPEN PROCESS INNOVATION

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Abstract

The paper is devoted to the development and description of a digital platform for railway transport terminal network management, tracking its performance indicators and working with customers in an interactive mode. The proposed digital platform is an open process innovation that enables comprehensive assessment and calculation of the terminal-warehouse infrastructure performance indicators. The study reports that business solutions digitalization became the main anti-crisis tool ensuring the market participants competitiveness. Based on the global digitalization trends analysis of the transport business, it is noted that in the era of consumer, the client needs ready-made solutions with a high degree of accuracy and simplicity. Digitalization of the transport and logistics business today is not just a tribute to fashion, but an urgent need. The study aims to address the issues of increasing customer orientation and accessibility of transport and logistics services, developing tools for evaluating terminal network and logistics facilities operations and increasing the terminal and warehouse business profitability. To implement the principles of customer orientation and one-stop online work, the concept and modular structure of a digital platform as a shared information "terminal network-carrier-client" space, including work with customer orders, terminal network location and status visualization was developed. To perform a comprehensive assessment, a logistic norm setting system was designed. Implementation of the proposed digital platform will increase the efficiency of interaction between the logistics service provider and the customer.

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1. Introduction

1.1. Digitalization trends in the transport and logistics services market

The global transport and logistics market is characterized by a surge in the new players emergence and the provision of new services to maximize the key business processes automation. The observed trends in the key players behavior in the transport and logistics market are a signal for active transition of all market participants to the online environment (Pokrovskaya, Fedorenko, & Khramtsova, 2018b). The problems of applying modern digital technologies in railway transport have been explored in various studies of both Russian (Fedorova et al., 2019) and foreign scientists (Court et al., 2017).

Some firms recognized this urgent need and started investing in their own platforms. Another part of the market is still not ready for digital changes and negatively refers to the "intrusion" of outside processes and individuals into their business. With the modern lengthening and complication of logistics chains, such major world companies as the railway ones (Deutsche Bahn (DB), JSC Russian Railways, etc.) are transformed into transport and logistics holdings and maintain outsourcing relations while providing a comprehensive service in supply chains.

The segment of terminal-warehouse and transportation activities logistics support is leading and most profitable nowadays (Pokrovskaya, Fedorenko, & Khramtsova, 2018a). The terminal and warehouse business unit has already become an important resource for improving activities efficiency, as evidenced by the JSC Russian Railways' experience of organizing the transport and logistics activities. This situation is quite predictable, since it is at the terminal-warehouse infrastructure facilities - logistics facilities (LF) that are part of the carrier's base terminal network - that the added value of goods and services is created.

At the same time, in the context of economy and transport informatization and digitalization, the new data processing technologies introduction, the transition of relationships between counterparties - service providers and customers - to the information realm, the railway companies' logistics function objectively requires a constant search for new improving activities methods, technologies, processes and procedures to save and increase the client base.

1.2. The main vectors of transportation activity digitalization

The logistics function of railway holding companies in the context of transportation informatization and digitalization is undergoing a period of dynamic development, which, in turn, requires new customer-oriented solutions that are "immersed" in the digital environment. It is known that digital business solutions in the "platform" format, including the software presented in this paper, enable businesses to be mobile, flexible and customer-oriented. Digital platforms are an important element of new smart transportation systems (Efimova, Haitbaev, & Pogorelova, 2020). The results of a digital platform introduction into public transportation were considered in a study by Italian scientists (Loffredo & Tufo, 2018).

We identified the following vectors of successful transportation business:

1. Quickly create new products and offer them to customers;

2. Create various sales and service channels;

3. Monitor the data quality, collect and accumulate data;

4. Automatically execute management, control and audit procedures with automatic and/or automated decision-making;

5. Reduce transactions costs in logistics chains of maximum length and depth;

6. Improve reliability of informational logistics in provision integrated transportation and logistics services;

7. Provide mobility and flexibility of situational management and critical decision-making in business processes in the 24x7 mode;

8. Ensure the conditions of a shared information realm with customers and contractors, ensure a "one-stop shop" mode and the end-to-end nature of services provision in the chain of added value and transport and logistics operations value creation.

The current pace and conditions for the goods logistics services rendering during their shipment to end consumers directly require new methodological solutions for performing such a comprehensive audit of delivery systems. For example, a technique developed with the use of a logistic norm setting system (Pokrovskaya, 2016) allows to make management decisions, creating and administering 4-PL delivery systems among other things.

The bottleneck this method is its scope and labor intensity, since the calculations for all significant indicators and deploying the criterial tool of terminalistics are not automated.

The article considers the digital platform introduction that simplifies the railway transport work as a new management tool. The possibilities of improving management processes with the use of digital platforms were repeatedly studied by Russian (Tolstykh, Shkarupeta, Purgaeva, & Fedorenko, 2019) and European (Kache & Seuring, 2017) researchers. The platform consists of a coherent set of digitized business process, data and infrastructure (Stalmašeková, Genzorová, Čorejová, & Gašperová, 2017).

2. Problem Statement

The importance of deploying the digital economy tools to evaluate modern logistics projects is not doubted in the current academic environment (Levitin & Mayboroda, 2017). To organize a cargo/goods delivery system to both the customer and the delivery organizer (the decision-maker), it is important to quickly and comprehensively evaluate the effectiveness of a particular LF "inclusion" in the logistics chain. In this case, the choice should be based on a whole range of LF parameters influencing its work efficiency and feasibility in the logistics chain.

Despite the active position of OJSC "Russian Railways" on the market and the successful implementation in its primary activity of big data technologies, smart contracts, the Internet of things, etc., currently there are separate digital solutions for the railway services market in Russia that cover only a part of the transportation process elements. A single digital "one-stop" platform for working with railway transportation customers is just being formed.

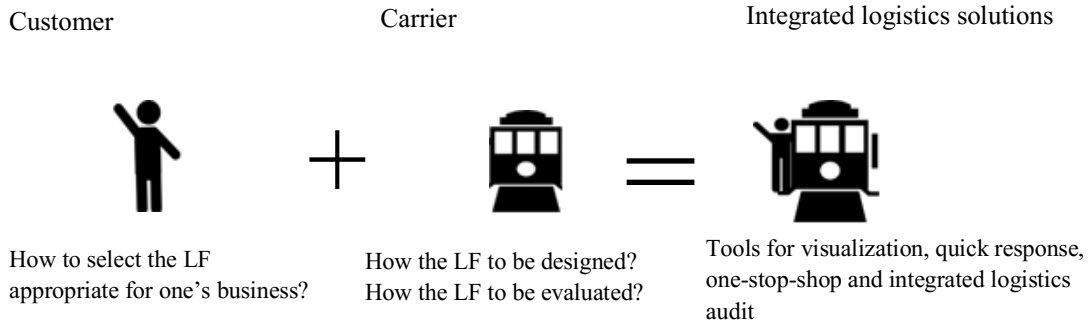## 3. Research Questions

The study addresses the following issues:

▪ How to increase customer focus and accessibility of transport and logistics services sold by OJSC "Russian Railways"?

▪ In what format can a shared digital "terminal network-carrier-client" space be created?

▪ What tools would make it possible to evaluate the terminal network effectiveness as a whole and its individual logistics facilities?

How to increase the terminal and warehouse business unit profitability of a railway carrier?

In particular, the issues that can be solved with the use of the proposed digital platform and the system of terminal network performance indicators logistic norming are visualized in Figure 01.

DIGITAL PLATFORM 'TERMINAL NETWORK"

Customer   Carrier   Integrated logistics solutions

How to select the LF   How the LF to be designed?   Tools for visualization, quick response,
appropriate for one's business? How the LF to be evaluated?   one-stop-shop and integrated logistics
                                                                audit

Source: authors.

Figure 01. Digital platform visualization

4. Purpose of the Study

The purpose of the study is to develop and describe an option of digital platform building for a terminal network management, performance indicators tracking and working with customers in an interactive mode. Such a digital platform is an open process innovation, enabling a comprehensive assessment and calculation of terminal-warehouse infrastructure performance indicators. In particular, to achieve the goal it was necessary to solve the following tasks:

▪ To implement the principles of customer orientation and online "one-stop –shop" work, the concept and modular structure of a digital platform was proposed as a shared information "terminal network-carrier-client" space, including work with customer orders, terminal network and individual LO location and status visualization;

▪ To perform a comprehensive assessment, a logistic norming system was developed.

5. Research Methods

In preparing this paper, a wide scientific and methodological toolkit was used. In particular, when analyzing existing digitalization trends, tools of statistical, systemic and economic analysis were applied. To formulate the functional objectives and the digital platform concept, the tools and methods of logistics, marketing, engineering, as well as the author's theory of terminalistics - the logistics of terminals and transport nodes – were deployed. Programming and computer modeling tools and methods were used for developing the digital platform demo version. The authors' mathematical models were used for LF comprehensive assessment methods design in the framework of the proposed logistics norming system.

6. Findings

The concept of an automated control system for the railway transport terminal network was developed during the study. Software modules provide the ability to calculate key parameters for the assessment, inventory, control and advertising of logistics facilities. The introduction of the concept and the accompanying informational solutions will enable the railway holding company (for example, OJSC "Russian Railways") to create a shared customer-oriented informational environment and reach the 4-th – 5th level of the logistics services provision. The key values of this project are the speed of delivery, transportation "Just in time", the seamless service and the receipt of all services in the "one-stop-shop" mode. An important innovation of the digital platform project is the implementation of electronic document exchange, blockchain and smart technologies. Cloud-based technology for organizing databases will allow the separation of the contractors' information flows and the carrier system, speed up the process of services/orders delivery, make it manageable and eliminate other losses.

To implement the procedures of a comprehensive assessment, logistic audit and terminal network and its LF current state indication, a logistics norming system, SLoN, is proposed - a set of economic, logistic and operational indicators of the terminal-warehouse infrastructure that determine its condition and development (85 in total). SLoN takes into account the logistical aspect associated with terminal-warehousing services for cargo flows, allows for a comprehensive assessment and establishing a decision vector for managing the logistics services quality.

In addition to performing calculations of the SLoN indicators, to perform a comprehensive assessment of both the terminal network as a whole and its individual elements – LF - performance, the digital platform functionality solves such problems as: creating an up-to-date database about LF and its administration; automation of terminal network activity logistics norming and visualization of the LF's location and current technical and technological state; interactively building a terminal network scheme using cloud services and the Internet.

One of the versions of a working map of the terminal infrastructure location and condition for facilities located in Russia was prepared. Using the C# syntax and the logistics norming method the tasks of map building, unloading, evaluating and visualizing the terminal network objects state parameters were performed. The following circumstance served as a prerequisite for the methodological support implementation of for the terminal network logistic norming in the software environment. To date, there is no module performing the functions of collecting, analyzing, conducting monitoring, evaluation and expert procedures regarding the status and further development forecasts of infrastructure elements and railway terminal network as a whole in the structure of the Russian Railways automated control system. This would make it possible to simplify the terminals key performance indicators calculation procedures as well as to optimize the situational management procedures for them in the operational regulation and evaluation of their work in real time.

Let us consider the basic structure of the program, its functional and modular composition (Figure 02).
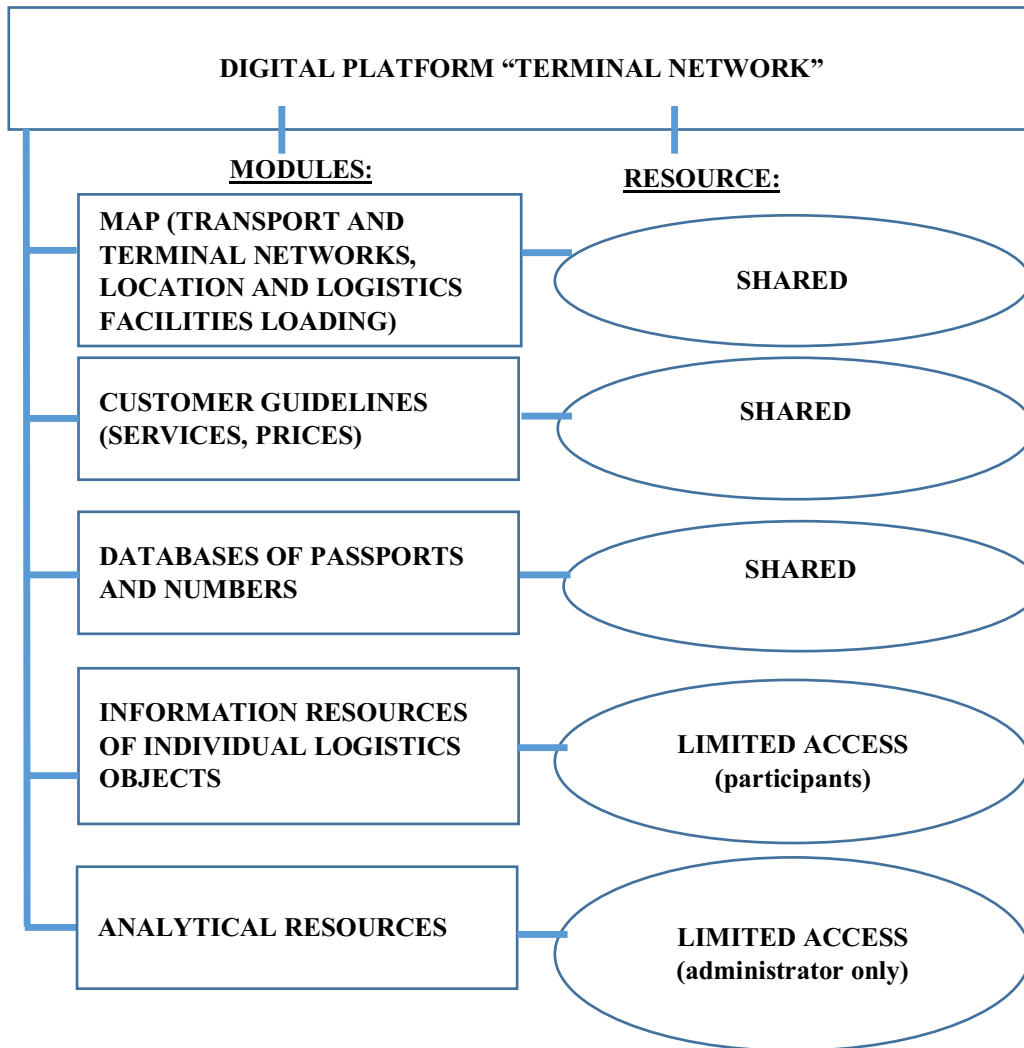
Source: authors.

Figure 02. Composition of information and reference materials and analytical resources of the
"Terminal Network" interactive map

The digital platform consists of the following elements: *computational* (data collection and uploading statistics and calculated state parameters of both individual LFs and the terminal network as a whole); *logistics audit* (using the economic and mathematical support of the proposed SLoN methodology, calculation and analysis of the terminal network performance indicators with the graphical results representation are performed); *interactive* (visual map of the current terminal network state with capability to collect orders for services provision); *management decisions generation* (the formation of the logistic audit results reports, comparing the values of indicators with normed ones, issuing decisions on efficiency, etc.).

7. Conclusion

The study results provide argument that in the era of consumer, the client needs ready-made solutions with a high degree of accuracy and simplicity. This is the meaning of the customer-oriented LF operation - to provide customers with comprehensive information of the infrastructure and service in the

most convenient, concise way, to expedite decision-making. The application of new solutions will enable the railway carrier as a key player in the transportation and logistics market to receive additional income, through the transit traffic growth among other things, and provide all transportation and logistics market participants with a reliable, modern system of wide range of cargo delivery applying both multimodal technologies and digital technologies of big data, blockchain and smart solutions. This will undoubtedly increase the terminal-warehouse segment efficiency in the transportation business, as well as the quality and complexity of the service provided by the carrier; will strengthen the local/domestic market players competitiveness in the context of international sanctions policies. Moreover, the application of proposals in rail transportation will lead the industry to increase the share of non-resource goods export with high added value, which will have an additional positive impact on the country's economy development and bring it closer to the most developed countries level.

It is fair to assume that the digital platform project developed in the study will become the main interaction tool for the transportation process participants and will create informational support for Russian Railways Holding preparation to advance to a new level of logistics provider. In the process of global industrial revolutions, being prepared for new changes is crucial. To ensure this, it is necessary to set the priorities correctly and to respond fully to the global society transformation challenges with the help of new formats and tools. Obviously, having reached the 4th stage of business digitalization, humanity as a whole and the transportation industry in particular will be on the verge of a new, 5th technological revolution.

References

Court, S., Kirkwood, L., Farnsworth, M., Orlovs, I., Shehab, E., & Tinworth, N. (2017). Requirements analysis of digital technology for the rail industry. *Advances in Transdisciplinary Engineering, 6,* 201-206. DOI: 10.3233/978-1-61499-792-4-201

Efimova, T. B., Haitbaev, V. A., & Pogorelova, E. V. (2020). Intellectual algorithms for the digital platform of "smart" transport. In S. Ashmarina, A. Mesquita, M. Vochozka (Eds.), *Digital Transformation of the Economy: Challenges, Trends and New Opportunities. Advances in Intelligent Systems and Computing, 908* (pp. 411-418). Cham: Springer. DOI: 10.1007/978-3-030-11367-4_40

Fedorova, N. V., Kukartsev, V. V., Tynchenko, V. S., Atluhanov, S. M., Gek, D. K., & Zagudaylova, E. A. (2019). Problems of the digital economy development in the transport industry. *IOP Conference Series: Earth and Environmental Science, 315*(3), 032047. DOI:10.1088/1755-1315/315/3/032047

Levitin, I. E., & Mayboroda, V. P. (2017). Digital economy in management and evaluation of transport and logistics projects and life cycle processes. In S. Shaposhnikov (Ed.), *International Conference "Quality Management, Transport and Information Security, Information Technologies"* (pp. 240-242). Piscataway, N.J.: IEEE. DOI: 10.1109/ITMQIS.2017.8085803

Loffredo, A., & Tufo, M. (2018). Digital work in the transport sector: In search of the employer. *Work Organisation, Labour and Globalisation, 12*(2), 23-37. DOI:10.13169/workorgalaboglob.12.2.0023

Kache, F., & Seuring, S. (2017). Challenges and opportunities of digital information at the intersection of Big Data Analytics and supply chain management. *International Journal of Operations & Production Management, 37*(1), 10-36. DOI: 10.1108/IJOPM-02-2015-0078

Pokrovskaya, O. D. (2016). Chi terminelistica reale come una nuova direzione scientifica. *Italian Science Review, 1*(34), 112-116.

Pokrovskaya, O. D., Fedorenko, R. V., & Khramtsova, E. (2018a). Formation of transport and storage systems. In V. Mantulenko (Ed.), *International Scientific Conference Global Challenges and Prospects of the Modern Economic Development. European Proceedings of Social and Behavioural Sciences, 57* (pp. 1213-1223). London: Future Academy. DOI: 10.15405/epsbs.2019.03.123

Pokrovskaya, O. D., Fedorenko, R. V., & Khramtsova, E. R. (2018b). Study of the typology of logistic entities using functional and logistic approach. In V. Mantulenko (Ed.), *International scientific conference global challenges and prospects of the modern economic development. European Proceedings of Social and Behavioural Sciences, 57* (pp. 91-101). London: Future Academy. DOI: 10.15405/epsbs.2019.03.10

Stalmašeková, N., Genzorová, T., Čorejová, T., & Gašperová, L. (2017). The impact of using the digital environment in transport. *Procedia Engineering, 192,* 231-236. DOI: 10.1016/j.proeng.2017.06.040

Tolstykh, T., Shkarupeta, E., Purgaeva, I., & Fedorenko, R. (2019) Transformation of positions, competences and skills in the digital economy industry. In V. Mantulenko (Ed.), *International Scientific Conference Global Challenges and Prospects of the Modern Economic Development. European Proceedings of Social and Behavioural Sciences, 57* (pp. 953-959). London: Future Academy. DOI: 10.15405/epsbs.2019.03.94